CANON AE-1

Similar models: AT-1, AV-1, A1

Fig. 1 -- top cover removed

Fig. 2 -- bottom cover removed

Fig. 3 -- front view, end cover plate removed

Fig. 4 -- mirror box, rewind side

Fig. 5 -- front view, mirror box removed

Fig. 6 -- IC pin voltages

Fig. 7 -- wiring pictorial, old style flex circuit

Fig. 8 -- wiring pictorial, new style flex circuit

ADJUSTMENT LOCATIONS:

SV - TV	A
Meter readout	B
Max-aperture correction (VR 3)	C
Comparator (VR 2)	D
Level (VR 1)	E
Gain	F
Battery test (Rch)	G
Oscillator	H
1/1000 second (RT')	I
Amplifier offset	J
Brake, first curtain	K
Travel time, second curtain	L
Travel time, first curtain	M
Wind overtravel	N
Trigger (timing) switch	O
Max-aperture correction pin	P

ADJUSTMENT VALUES:

Curtain-travel time: 11.3ms ± 0.3ms (34mm distance)

Flange-focal distance: 42.14mm (flange to pressure-plate rails)
41.9mm (flange to film-guide rails)

Maximum-aperture correction pin: 5.7mm +0 - 0.2mm from front surface of pin to front surface of lens-mounting ring.

SV - TV resistor: At the settings of bulb and ASA 3200, there should be a 45-degree angle between the center of the tab (the tab opposite the wire-hooking tab) and a line drawn perpendicular to the back of the camera -- the position shown in Fig. 1. At the settings of 1/60 second and ASA 100, the brush on the underside of the SV - TV resistor should be to the back of the camera; some cameras have a timing mark on the SV - TV board to mark the brush position.

Initial tension on SV - TV resistor: 1 - 1 1/2 turns

Wind overtravel: 0.05 - 0.15mm between the second-curtain cam (latching surface) and the Mg3 armature, shutter cocked. To adjust, rotate the second-curtain cam (adjustment N) after loosening the two allen-head setscrews on its outer circumference.

Curtain timing: Time the second curtain so that, when held open by the Mg3 armature, the bar is 5mm behind the lead edge of the focal-plane aperture. Time the first curtain for a 1-bar overlap on the cocking stroke. To time the curtains, first loosen the left-hand screws holding the pinions at the tops of the curtain rollers; you can then turn the rollers to position the curtains.

SPECIAL TOOLS FOR METER CALIBRATION:

1. 4.7K resistor
2. Modified top cover. To modify a top cover, first cut off the wind-lever side. Then cut a slot in the top cover to allow access to the variable resistors.

ADJUSTMENT SEQUENCE:

1. Connect the 4.7K resistor between the CCC contact, Fig. 1, and the camera body (ground). Close SW1. The needle should indicate f/4. If not, rotate the meter housing (adjustment B).

2. Set ASA 100, 1/125 second -- top cover removed, no lens. Close SW1 and vary the light reaching the photocell. The low-light LED should flicker between the needle indications of f/4 and f/5.6. Adjust variable resistor C, Fig. 1, so that, with the f/1.4 lens installed, the LED begins to flicker when the needle moves to the dot above the f/1.2 calibration.

3. Install the modified top cover and the FD lens. Close SW1. Note the needle position at two light levels:

   (1) EV 9, ASA 100, 1/15 second
   (2) EV 15, ASA 100, 1/1000 second

   In both situations, the needle should be at or near f/5.6. Adjust variable resistor F so that the nee-

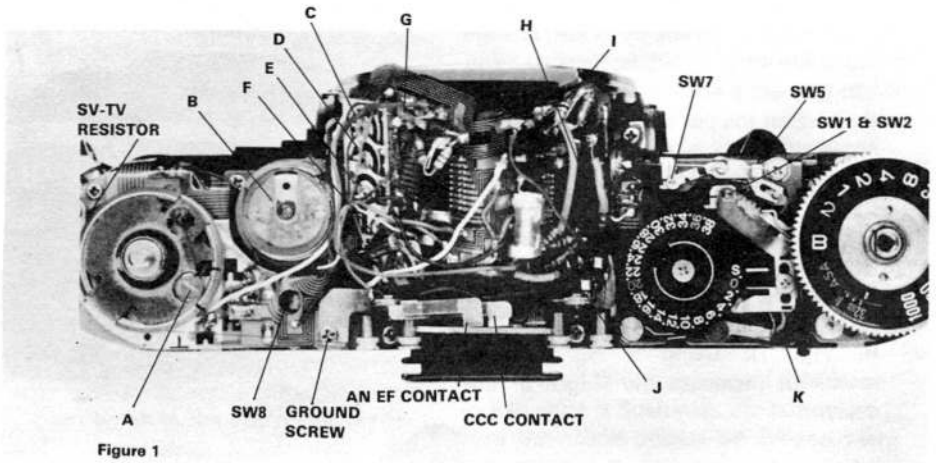

Figure 1

dle moves to the same position under both conditions.

4. Set EV 12, ASA 100, 1/125 second. Adjust variable resistor E so that the needle indicates f/5.6.

5. Set EV 12, ASA 100, 1/125 second, lens on automatic position. Release the shutter. The diaphragm should close to f/5.6. To check, turn the diaphragm-setting ring off the automatic position and push in the stop-down lever until it latches. The lens should now stop down to f/5.6. Watch the diaphragm leaves as you slowly rotate the diaphragm-setting ring toward the larger apertures. The diaphragm leaves should start to open when the diaphragm-setting ring reaches the f/5.6 calibration. If not, adjust with variable resistor D.

Additional adjustments if you replace an IC or flex circuit:

Battery test (PX3 replacement): Connect a variable-voltage power supply to the battery terminals. Then note the voltage setting at which the shutter releases and set the power supply according to the following chart:

Shutter releases:	Set power-supply voltage to:
between 4.2 and 4.39V	4.6V
between 4.4 and 4.59	4.7V
between 4.6 and 4.8V	4.8V

After setting the proper power-supply voltage, close the battery-test switch SW8, Fig. 1. The needle should center in the battery-test square. If not, change the value of Rch (adjustment G). You can connect a 4.7K pot in place of Rch; then adjust the pot to center the needle. Measure the value of the pot to find the proper value for Rch.

Self-timer delay (PX2 replacement): The length of the self-timer delay should be 10 seconds. To increase or decrease the delay, replace resistor Rosc (adjustment H, Fig. 1). Using a higher value resistance increases the length of the delay.

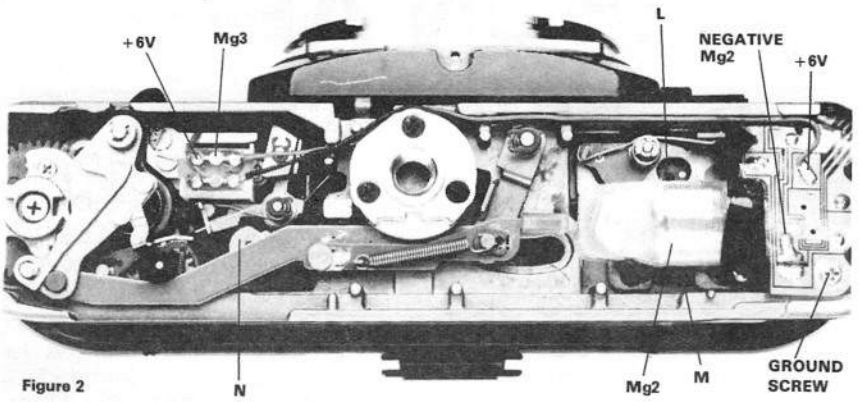

Figure 2

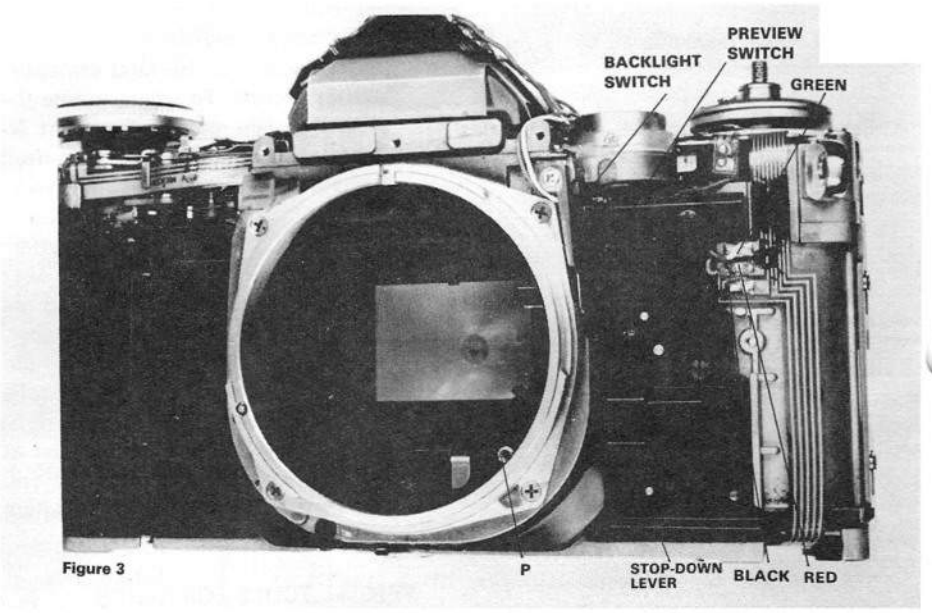

Figure 3

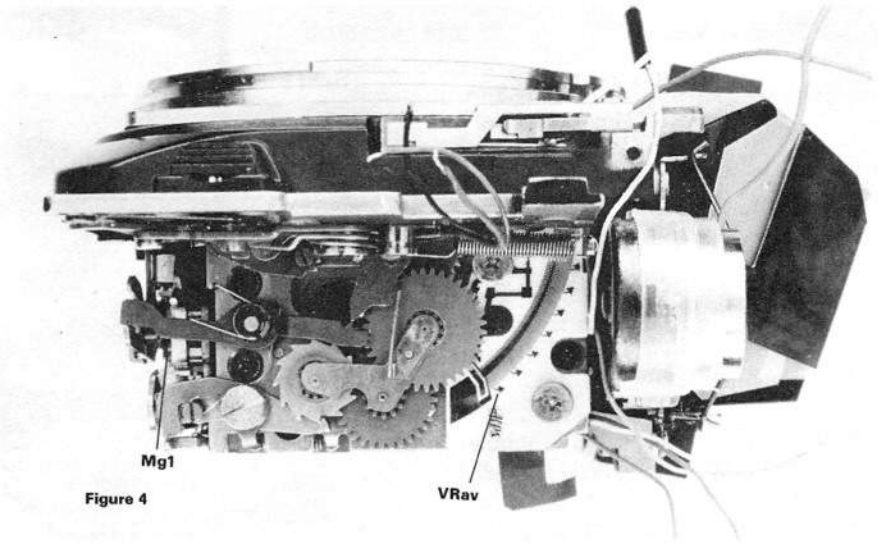

Figure 4

Amplifier offset (PX1 replacement): Short pin 8 of PX1 to pin 7 while measuring the offset voltage between pin 8 and pin 6. You should measure 0V (tolerance -- +5mv). If not, connect a 30K pot in place of the larger of the two null resistors. Adjust the pot until your output is within tolerance. Then install a fixed resistor of the same value.

DISASSEMBLY HIGHLIGHTS:

Control positions: shutter speed -- bulb
film speed -- ASA 3200

Location of left-hand threads: screws holding pinions at tops of winding rollers in shutter unit.

Precautions:

a. Remove the battery before unsoldering any wires.
b. Handle the flex circuit carefully to avoid tearing.
c. Do not use M.E.K. on plastic parts.

Sequence:

1. bottom cover
2. front decorator plate
3. top cover (be careful that the slot in the front of the top cover does not catch and tear the flex circuit)
4. battery
5. unsolder purple wire from flex circuit (from RB1, Fig. 7, or Db, Fig. 8)
6. unsolder white wire from SV - TV board
7. front leatherette
8. end cover plate (3 screws, back-latch spacers will be loose)
9. unsolder 3 wires from front of flex circuit, Fig. 3
10. unsolder wires from top of camera:
    - red galvanometer wire
    - orange to VR av *
    - red to VR avo *
    - white to VR avo
    - blue to R1
    - green to SV-TV board

    * note differences in positions of orange wire and red wire between old-style board, Fig. 7, and new-style board, Fig. 8

11. remove solder from 4 LED pins, Fig. 7 (alternately, leave LEDs soldered to the flex circuit and pull them free from the LED holder around the galvanometer)

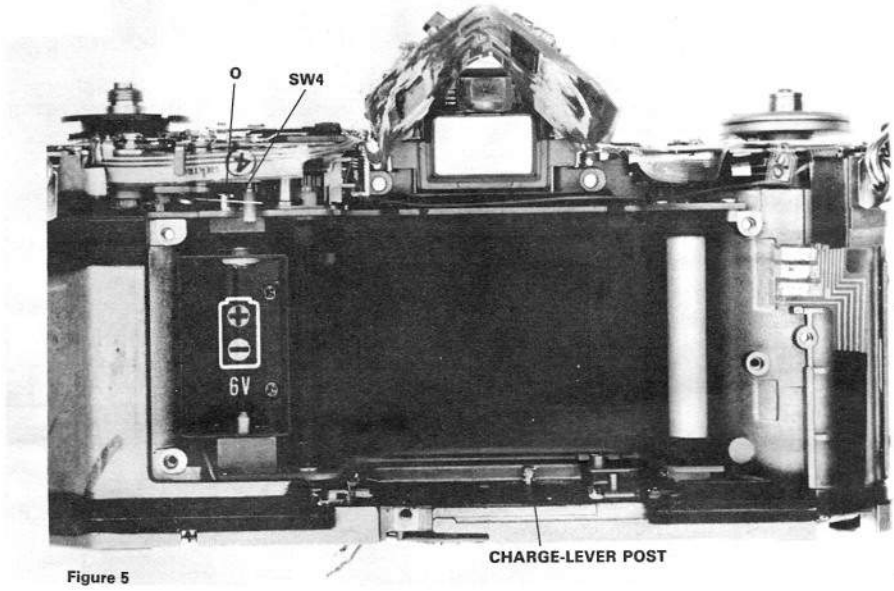

Figure 5

12. ground screw and ground plate, Fig. 1 (may be a loose washer under the ground plate)

13. cock shutter

14. 2 screws, one on each side of eyelens

15. 5 front-plate screws

16. front-plate/mirror-box assembly

REASSEMBLY HIGHLIGHTS:

1. To replace the speed knob, start its large tab into the slot in the speed-knob coupler. Then turn the speed knob counterclockwise until the "B" calibration aligns with the index.

2. To check the shutter operation before installing the mirror box, replace the ground screw, Fig. 1, and the battery. Cock the shutter and push down SW1 and SW2. The armature should jump away from Mg2. Then push the armature against Mg3. Release the shutter by pushing the first-curtain latch toward the back of the camera. If you hold in the first-curtain latch, the shutter should time out according to the shutter-speed setting.

3. To replace the front-plate/mirror-box assembly, make sure that the shutter is in the released position. Then push the charge-lever post all the way to the left in Fig. 5. Also disengage the mirror-release armature from the combination magnet Mg2.

TROUBLESHOOTING:

Typical battery drain:

Meter: 18ma
Shutter open: 40 - 45ma
Battery test: 28ma
Self timer: 36ma

Behavior without battery: shutter won't release, no meter, no self timer

Behavior without lens: "M" LED in finder always flashes

Galvanometer coil resistance: 340 - 350 ohms

Vc voltage measured at CCC contact: 1.2V

KVc voltage measured at resistor board: 1.8 - 2V

Troubleshooting steps for specific problems:

Note: For electronic problems, first check for the Vc and KVc constant voltages. If you do not measure the proper voltages, PX3 may be defective.

1. Shutter won't release, meter inoperative

   Battery voltage to flex circuit

   Check for +6V between ground and the red lead to Mg3, Fig. 2. No voltage -- check battery box

and wiring. Also check for +6V at the red wire to the flex circuit, Fig. 2. No voltage -- check red-wire solder connections.

Short across battery compartment

Several places where +6V appears could be shorted to ground. Check first to see if Mg3 is shorted to ground, if the positive side of the LEDs is shorted to ground, or if capacitor C47 is shorted.

Transistor TR

Check for close to +6V at the collector of TR, Fig. 8, with SW1 closed. No voltage -- TR defective or TR bias path open.

Switches SW1 and SW2

To cause both symptoms, both SW1 and SW2 must fail to make contact.

2. Shutter won't release, meter works

SW5, poor contact or insufficient tension

Reform and/or clean the movable blade of SW5. You can check the switch by shorting pin 14 of PX2 to ground. If the shutter will then release, SW5 is the problem.

Combination magnet Mg2 or release capacitor C47

Check both components by shorting between the negative lead of Mg2, Fig. 2, and ground. If the mirror then releases, both Mg2 and C47 are good. If the mirror still won't release, either Mg2 or C47 could be at fault. Check Mg2 by measuring the coil resistance (approximately 11 ohms).

Open in flex circuit

Check for continuity between SW5 and pin 14 of PX2.

Check for continuity between the negative side of Mg2 and pin 2 of PX2.

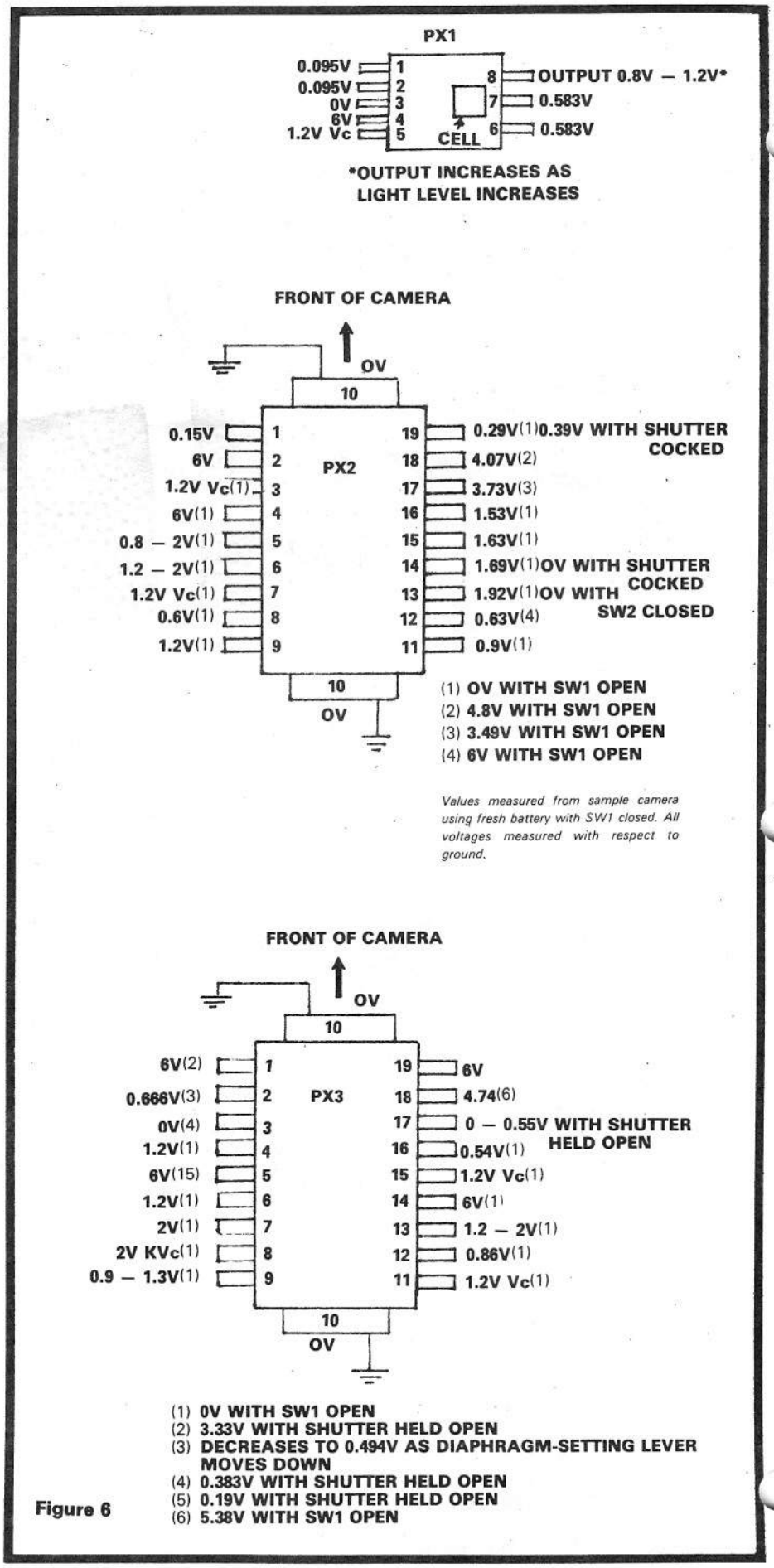

Figure 6

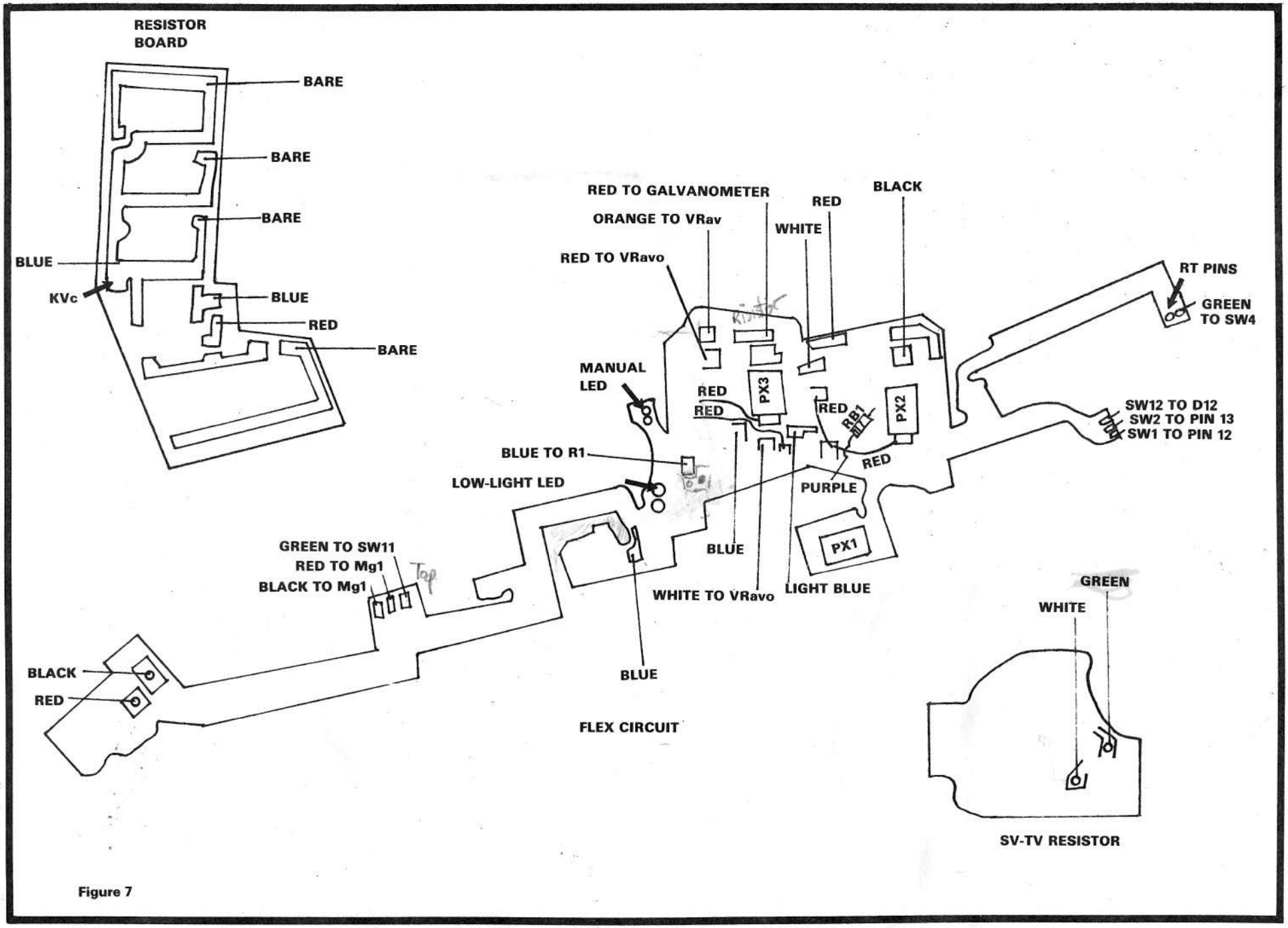
RESISTOR BOARD
BARE
BARE
BARE
BLUE
KVc
BLUE
RED
BARE
RED TO GALVANOMETER
ORANGE TO VRav
RED TO VRavo
WHITE
RED
BLACK
RT PINS
GREEN TO SW4
MANUAL LED
RED
RED
PX3
RED
RB1
PX2
SW12 TO D12
SW2 TO PIN 13
SW1 TO PIN 12
BLUE TO R1
LOW-LIGHT LED
RED
PURPLE
GREEN TO SW11
RED TO Mg1
BLACK TO Mg1
BLUE
PX1
WHITE TO VRavo
LIGHT BLUE
BLACK
RED
BLUE
FLEX CIRCUIT
GREEN
WHITE
SV-TV RESISTOR

Figure 7

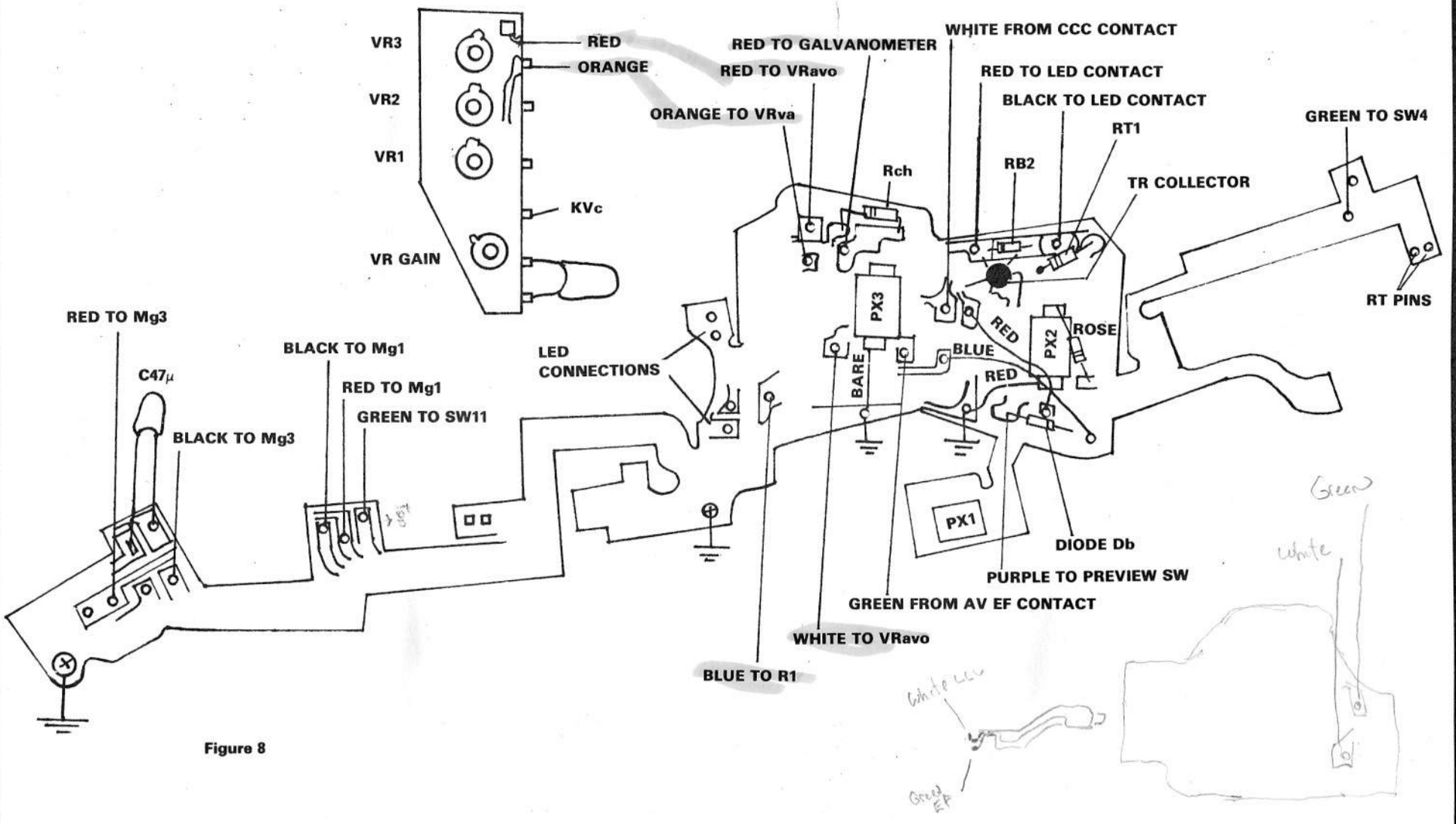
VR3
VR2
VR1
VR GAIN
RED
ORANGE
KVc
RED TO GALVANOMETER
RED TO VRavo
ORANGE TO VRva
WHITE FROM CCC CONTACT
RED TO LED CONTACT
BLACK TO LED CONTACT
RT1
RB2
TR COLLECTOR
Rch
GREEN TO SW4
RT PINS
RED TO Mg3
C47μ
BLACK TO Mg3
BLACK TO Mg1
RED TO Mg1
GREEN TO SW11
LED
CONNECTIONS
PX3
PX2
PX1
BARE
RED
BLUE
ROSE
RED
DIODE Db
PURPLE TO PREVIEW SW
GREEN FROM AV EF CONTACT
WHITE TO VRavo
BLUE TO R1

Figure 8

3. Both curtains cross the aperture together

Mg3, open coil

Check by shorting between the black-wire contact to Mg3, Fig. 2, and ground. If the coil is good, the shutter will stay open. Resistance of Mg3 coil --approximately 220 ohms.

Wind overtravel insufficient

Open in flex circuit

Check for continuity between black lead of Mg3 and pin 1 of PX3.

4. Camera always delivers self-timer operation

SW7, constantly closed

Check to see if the wire blade of SW7 is touching the switch tab, Fig. 1. The two contacts should not touch. Impact may have forced the wire blade to the front of the tab, thereby keeping SW7 closed.

5. Meter does not turn on when you depress the release button part way

SW1, poor contact

Check the voltage to the collector of TR, Fig. 8, with SW1 closed. If you measure no voltage, also close SW2. If you now measure +6V at the collector of TR, SW1 is not making good contact.

6. Shutter hangs open

Tungsten wire slipped under speed selector

The tungsten wire may then short the shutter-speed resistors to ground, a result of dropping the camera on the wind-lever end.

RT connector pin touching camera body

With the shutter released, check for direct continuity between ground and the RT connector pin closer to the end of the camera, Fig. 8. Direct continuity indicates that the RT connector pin is touching the body casting.

Open in shutter-speed (RT) resistor ring

Check the resistance between the RT connector pins. The resistance should decrease as you set faster shutter speeds. If you find an open, clean and reform the brush contact or replace the RT board. Approximate resistance values:

1 second -- 1M
1/15 second -- 63K
1/125 second -- 7.7K
1/1000 second -- 950 ohms

Other possibilities:

- trigger switch SW4 not opening
- PX3, pin 15 shorted to pin 14
- bulb contact shorted to ground
- break in flex circuit between RT and RT'
- break in flex circuit between timing capacitor CT and diode D12

7. Diaphragm always stops down fully, meter o.k.

VR av, poor contact or open

Check the resistance between the orange wire, Fig. 7, at the top of the flex circuit and ground. Cock the shutter and push in the stop-down lever to free the diaphragm-setting lever. Slowly push the diaphragm-setting lever toward the bottom of the mirror box. The resistance should smoothly decrease as the diaphragm-setting lever moves down. Resistance range -- approximately 1.7K to 1K. If you get erratic resistance readings or an open, clean or replace VR av, Fig. 4.

8. Diaphragm always remains fully open, meter o.k.

Mg1, open coil

With the lens and battery installed, short between the black wire at the front of the camera and ground as you release the shutter. The diaphragm should stop down fully. If it does, Mg1 is o.k. If it doesn't, Mg1 may have an open coil. Check the coil continuity between the red wire at the front of the camera and the black wire. Approximate coil resistance -- 350 ohms.

CCC contact touching AV EF contact, Fig. 1

9. Shutter only delivers 1/60 second

CCC contact, Fig. 1, shorted to ground

10. Needle always pegs to bottom of scale

PX1 defective or poor solder connections

Check the output of PX1 (pin 8). You should measure from 1.1 to 1.15V without the top cover. If the voltage is below 0.8V, you must normally replace PX1.

SV-TV resistor, poor brush contact

Check the continuity of the SV-TV resistor between pin 6 of PX3 and ground. You should see the resistance decrease as you set slower shutter speeds.

No KVc at resistor board

Check for around 2V KVc at the resistor board, Fig. 7 and Fig. 8, or at pin 8 of PX3. No voltage -- replace PX3.

VR avo, poor contact or open

Disconnect the red wire that goes to VR avo, Fig. 7 or Fig. 8. Then measure the resistance between the red wire and ground as you push in the maximum-aperture correction pin. The resistance should smoothly increase from around 9K to around 18K. If not, check VR avo (behind VR av, Fig. 4) for poor brush contact or dirt.

13. Meter and diaphragm several stops overexposure

VR avc, poor contact or open

3. Both curtains cross the aperture together

Mg3, open coil

Check by shorting between the black-wire contact to Mg3, Fig. 2, and ground. If the coil is good, the shutter will stay open. Resistance of Mg3 coil --approximately 220 ohms.

Wind overtravel insufficient

Open in flex circuit

Check for continuity between black lead of Mg3 and pin 1 of PX3.

4. Camera always delivers self-timer operation

SW7, constantly closed

Check to see if the wire blade of SW7 is touching the switch tab, Fig. 1. The two contacts should not touch. Impact may have forced the wire blade to the front of the tab, thereby keeping SW7 closed.

5. Meter does not turn on when you depress the release button part way

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Check the voltage to the collector of TR, Fig. 8, with SW1 closed. If you measure no voltage, also close SW2. If you now measure +6V at the collector of TR, SW1 is not making good contact.

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Tungsten wire slipped under speed selector

The tungsten wire may then short the shutter-speed resistors to ground, a result of dropping the camera on the wind-lever end.

RT connector pin touching camera body

With the shutter released, check for direct continuity between ground and the RT connector pin closer to the end of the camera, Fig. 8. Direct continuity indicates that the RT connector pin is touching the body casting.

Open in shutter-speed (RT) resistor ring

Check the resistance between the RT connector pins. The resistance should decrease as you set faster shutter speeds. If you find an open, clean and reform the brush contact or replace the RT board. Approximate resistance values:

1 second -- 1M
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1/1000 second -- 950 ohms

Other possibilities:

- trigger switch SW4 not opening
- PX3, pin 15 shorted to pin 14
- bulb contact shorted to ground
- break in flex circuit between RT and RT'
- break in flex circuit between timing capacitor CT and diode D12

7. Diaphragm always stops down fully, meter o.k.

VR av, poor contact or open

Check the resistance between the orange wire, Fig. 7, at the top of the flex circuit and ground. Cock the shutter and push in the stop-down lever to free the diaphragm-setting lever. Slowly push the diaphragm-setting lever toward the bottom of the mirror box. The resistance should smoothly decrease as the diaphragm-setting lever moves down. Resistance range -- approximately 1.7K to 1K. If you get erratic resistance readings or an open, clean or replace VR av, Fig. 4.

8. Diaphragm always remains fully open, meter o.k.

Mg1, open coil

With the lens and battery installed, short between the black wire at the front of the camera and ground as you release the shutter. The diaphragm should stop down fully. If it does, Mg1 is o.k. If it doesn't, Mg1 may have an open coil. Check the coil continuity between the red wire at the front of the camera and the black wire. Approximate coil resistance -- 350 ohms.

CCC contact touching AV EF contact, Fig. 1

9. Shutter only delivers 1/60 second

CCC contact, Fig. 1, shorted to ground

10. Needle always pegs to bottom of scale

PX1 defective or poor solder connections

Check the output of PX1 (pin 8). You should measure from 1.1 to 1.15V without the top cover. If the voltage is below 0.8V, you must normally replace PX1.

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Check the continuity of the SV-TV resistor between pin 6 of PX3 and ground. You should see the resistance decrease as you set slower shutter speeds.

No KVc at resistor board

Check for around 2V KVc at the resistor board, Fig. 7 and Fig. 8, or at pin 8 of PX3. No voltage -- replace PX3.

VR avo, poor contact or open

Disconnect the red wire that goes to VR avo, Fig. 7 or Fig. 8. Then measure the resistance between the red wire and ground as you push in the maximum-aperture correction pin. The resistance should smoothly increase from around 9K to around 18K. If not, check VR avo (behind VR av, Fig. 4) for poor brush contact or dirt.

13. Meter and diaphragm several stops overexposure

VR avc, poor contact or open

Disconnect the green wire from the SV - TV board, Fig. 7. Then measure the resistance between the green wire and ground as you push in the maximum-aperture correction pin. The resistance should smoothly decrease from around 13K to less than 1K. If you measure an open or get erratic resistance readings, check VR avc (behind VR av, Fig. 4).

14. Manual LED doesn't flash at manual f/stop settings

SW11, poor contact

Check for continuity between the green wire at the front of the camera, Fig. 3, and ground with a lens installed. You should read an open on auto, direct continuity on a manual f/stop. No continuity on manual -- check manual switch SW11 (back of front-plate assembly, wind side) and wiring.

15. Fast shutter speeds too slow

Spring on Mg3 armature disconnected

Adjustment on trigger switch SW4 incorrect

You can adjust the fast shutter speeds either by changing fixed resistor RT', Fig. 1, or by turning the eccentric post on the trigger switch SW4, Fig. 5.

Frequently repaired sections:

1. PX1 defective or poor solder connections at IC pins, causing the needle to peg to the bottom of the scale and the low-light LED to flash on and off regardless of the light conditions.

2. VR av, dirt on brush and resistance band causing diaphragm to always stop down fully. The dirt eventually wears opens in the resistance band, requiring replacement of the VR av assembly.

3. PX2 and PX3 defective, frequently caused by the owner using an electronic-flash unit not designed for the camera. If the owner installs a charged electronic-flash unit on the hot shoe -- and if the unit's sync contacts happen to engage the contacts in the camera's hot shoe -- PX2 and PX3 may be damaged by the trigger-capacitor voltage. The damage often results in a failure of the shutter-speed timing circuit and of the meter readout. To check, measure the Vc voltage at the CCC contact. If the Vc voltage is around 0.5V rather than 1.2V, replace PX2 and PX3.

4. SW5 dirty or insufficient pressure, causing the combination magnet Mg2 to fail to repel its armature. The shutter then won't release. You can sometimes correct the problem by simply pushing the armature away from Mg2, Fig. 2. Although the camera may continue to work properly, it's safer to remove the top cover and clean SW5.

5. Tungsten wire jumps out of place due to impact, sometimes catching on top cover. The problem sometimes corrects itself when you remove the top cover, thereby allowing the tungsten wire to return to its proper position.

OTHER COMMENTS:

1. To clean the focusing screen, remove the front-plate/mirror-box assembly. Otherwise, you'd have to pull the flex circuit to uncover the pentaprism.

2. You can obtain the individual replacement components or the complete flex circuit. However, a replacement flex circuit comes without fixed resistors Rch and RT'. Rch provides the adjustment for the battery-test circuit, and RT' provides the adjustment for the fast shutter speeds. Switch Rch and RT' from the old board to the new board and adjust.

3. The flex circuit has been modified several times. But the wiring for the first, second, and third types matches Fig. 7. In the fourth type, the main wiring variation is in the positions of the red wire and the orange wire, Fig. 8. The flex circuits are interchangeable.